5312

CHLORINE-RICH APATITES IN SNCs: EVIDENCE FOR MAGMA-BRINE INTERACTIONS ON MARS?

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Chlorine-rich apatites are ubiquitous in Martian meteorites. Chlorapatite is rare on Earth, as fluorapatite is the dominant phosphate phase in terrestrial igneous rocks. Recent work suggests that the chlorapatite of the Stillwater and Bushveld Intrusions results from the interactions of magma and briny fluids [1]. Due to the partitioning of F/Cl in magmatic systems, there is not a simple mechanism for forming chlorapatites without the addition of a Cl-rich component. I propose that all SNCs that contain chlorapatite formed from interactions of SNC parent magmas with subsurface brines on Mars. If true, one must question our basic assumptions regarding Martian geochemistry, as derived from the study of SNC meteorites. For example, high D/H in chlorapatites [e.g., 2] may not be magmatic values, but a signature of the briny fluid. Theories on the chemical composition of the Martian mantle, as derived from the chemical composition of SNCs [e.g., 3], need to be re-evaluated in light of the interactions of SNC parent magmas with brines. Partitioning studies of trace elements between Fe-rich SNC-type magmas and saline fluids are needed to properly evaluate the role of brines in Martian magmatic systems.

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5222

SOLAR WIND NOBLE GASES—PRELIMINARY RESULTS FROM BULK METALLIC GLASS FLOWN ON GENESIS

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Introduction: The solar wind (SW) is the major source of information to study the solar composition of volatile elements. It provides insights about the Sun's present state, its evolution and the composition of the proto-solar nebula. SW noble gases can be used to study processes causing fractionation between the Sun and the SW. Moreover they are useful to determine compositional variations for distinct SW energy regimes including the high energy SEP component apparently abundant in lunar samples [1]. We will present noble gas data collected on Genesis [2] with a bulk metallic glass target (BMG) [3].

Experiment: The BMG plate was exposed during the entire SW collecting period of 884 days. So far, extensive X-ray photo-electron spectroscopy (XPS) analyses were carried out on the BMG to determine the thickness and composition of surface contamination ubiquitous on Genesis targets. For qualitative information XPS energy scans (0–1200 eV) were measured on 90 spots (∅ = 100 μm). On areas revealing most intense contamination signals tilt angle measurements were done to determine the thickness.

Noble gases will be released by pyrolysis of the BMG at about 1300 °C and by closed system stepwise etching (CSSE) [4]. This depth resolving technique allows us to distinguish noble gases related to the SW from ions implanted at higher energies (SEP) and thus implanted to larger depth.

Results: The XPS data show that contamination is omnipresent on the BMG surface. The major contaminant is a polymerized organic layer mainly consisting of Si, C, O, N and minor F. Its signals are highest close to the holes used for screws to mount the BMG. This supports the idea that the organic layer is related to glue the screws of the BMG were fixed with. However, since the BMG element Zr is always visible in the XPS spectra, contamination at the measured spots is very unlikely to be thicker than 10 nm (max. depth resolution of XPS used for this study). If the organic layer has been deposited homogeneously on the surface, which we expect after extensive XPS survey, then this layer would not have influenced the noble gas trapping noticeably. Minor elements as Mg stem from soil particles of the Utah desert.

Overall, XPS analyses and microscopic studies indicate that the BMG is suitable for precise noble gas analysis. Noble gas results will be discussed at the conference.

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